

CLAIMS

What is claimed is:

- 1 1. A magnetic head having an air bearing surface (ABS), comprising:  
2 an antiparallel (AP) pinned layer structure;  
3 a bias layer spaced apart from the AP pinned layer structure, a magnetic moment  
4 of the bias layer being pinned; and  
5 a free layer positioned between the AP pinned layer structure and the bias layer;  
6 wherein the bias layer provides magnetic stability to the free layer.
- 1 2. A head as recited in claim 1, wherein the AP pinned layer structure includes at  
2 least two pinned layers having magnetic moments that are self-pinned antiparallel  
3 to each other, the pinned layers being separated by an AP coupling layer.
- 1 3. A head as recited in claim 2, wherein a thickness of the AP coupling layer and  
2 thicknesses of the pinned layers are selected to provide a saturation field above  
3 about 10 KOe.
- 1 4. A head as recited in claim 2, wherein the AP pinned layer structure has a positive  
2 magnetostriction, the AP pinned layer structure having a magnetic anisotropy  
3 oriented perpendicular to an ABS of the reading head.

- 1    5.    A head as recited in claim 1, wherein the bias layer has a negative  
2            magnetostriction, wherein a magnetic moment of the bias layer is pinned parallel  
3            to a track width of the reading head.
- 1    6.    A head as recited in claim 1, wherein a magnetic thickness of the bias layer is  
2            about the same as a magnetic thickness of the free layer for creating a flux closed  
3            structure.
- 1    7.    A head as recited in claim 1, wherein the bias layer comprises NiFe, wherein a  
2            ratio of Ni/Fe in the bias layer is at least about 9/1.
- 1    8.    A head as recited in claim 1, wherein the bias layer comprises CoNiNb.
- 1    9.    A head as recited in claim 1, wherein a magnetic moment of the bias layer is  
2            oriented antiparallel to the magnetic moment of the free layer.
- 1    10.   A head as recited in claim 1, wherein the head forms part of a GMR head.
- 1    11.   A head as recited in claim 1, wherein the head forms part of a CPP GMR sensor.
- 1    12.   A head as recited in claim 1, wherein the head forms part of a CIP GMR sensor.
- 1    13.   A head as recited in claim 1, wherein the head forms part of a tunnel valve sensor.

1 14. A magnetic head having an air bearing surface (ABS), comprising:  
2 an antiparallel (AP) pinned layer structure having two pinned layers having  
3 magnetic moments that are self-pinned antiparallel to each other, the  
4 pinned layers being separated by an AP coupling layer;  
5 a bias layer spaced apart from the AP pinned layer structure, a magnetic moment  
6 of the bias layer being pinned; and  
7 a free layer positioned between the AP pinned layer structure and the bias layer,  
8 the free layer having a magnetic moment oriented antiparallel to the  
9 magnetic moment of the bias layer and perpendicular to magnetic  
10 moments of the pinned layers;  
11 wherein the bias layer provides magnetic stability to free layer.

1 15. A head as recited in claim 14, wherein a thickness of the AP coupling layer and  
2 thicknesses of the pinned layers are selected to provide a saturation field above  
3 about 10 KOe.

1 16. A head as recited in claim 14, wherein the AP pinned layer structure has a  
2 positive magnetostriction, the AP pinned layer structure having a magnetic  
3 anisotropy oriented perpendicular to an ABS of the reading head.

- 1 17. A head as recited in claim 14, wherein the bias layer has a negative  
2 magnetostriiction, wherein a magnetic moment of the bias layer is pinned parallel  
3 to a track width of the reading head.
- 1 18. A head as recited in claim 14, wherein a magnetic thickness of the bias layer is  
2 about the same as a magnetic thickness of the free layer for creating a flux closed  
3 structure.
- 1 19. A head as recited in claim 14, wherein the bias layer comprises NiFe, wherein a  
2 ratio of Ni/Fe in the bias layer is at least about 9/1.
- 1 20. A head as recited in claim 14, wherein the bias layer comprises CoNiNb.
- 1 21. A head as recited in claim 14, wherein the head forms part of a GMR head.
- 1 22. A head as recited in claim 14, wherein the head forms part of a CPP GMR sensor.
- 1 23. A head as recited in claim 14, wherein the head forms part of a CIP GMR sensor.
- 1 24. A head as recited in claim 14, wherein the head forms part of a tunnel valve  
2 sensor.
- 1 25. A magnetic storage system, comprising:

- 2 magnetic media;
- 3 at least one head for reading from and writing to the magnetic media, each head
- 4 having:
- 5 a sensor having the structure recited in claim 1;
- 6 a write element coupled to the sensor;
- 7 a slider for supporting the head; and
- 8 a control unit coupled to the head for controlling operation of the head.